MODERN METHODS OF BUILDING

By PROFESSOR S. D. ADSHEAD, M.A., M.Arch., F.R.I.B.A.

AND

THE CONSTRUCTION OF THE MODERN HOUSE

By HERBERT A. WELCH, F.R.I.B.A.

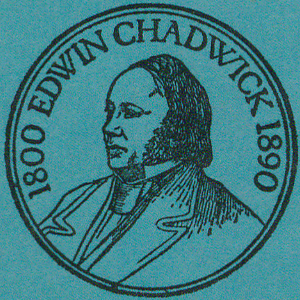
BEING

TWO CHADWICK LECTURES

UNDER

"THE BOSSOM LECTURES AND SCHOLARSHIP GIFT"

given in the "Henry Jarvis Room"
of the Royal Institute of British Architects,
December 1 and 17, 1936



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BY
P. S. KING & SON, LTD
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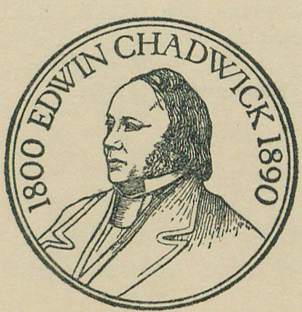

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PRINTED IN GREAT BRITAIN

FOREWORD

In these days of rapid change no field of activity has been so disturbed as that which is represented by the building industry. Architects and builders have neither the time nor the opportunity to make a personal examination of all that is happening.

They may rely upon the opinion of those who have experimented. They may visit the Building Centre in Bond Street. They may visit the Building Exhibitions that are held at Olympia and at the Horticultural Hall, and they may study the reports of the Building Research Station; but even then, if they have had no personal experience of the use of a new material, or a new method of building that has recently been introduced, they must depend upon their own personal experience and innate judgment.

The tendency is for architects and builders to follow a safe course; use only well-tried methods and old materials, avoid experiments, and make sure that nothing will go wrong. But, these are not the methods of a people, or of a country, that must perforce keep abreast of the times. This is not the way to success in a competitive age.

We are therefore indebted to the Trustees of the Chadwick Trust and to Mr. Alfred Bossom, M.P., for providing these lectures.

The first of a Course of Six Lectures was delivered by Professor S. D. Adshead at the rooms of the Royal Institute of British Architects at 66, Portland Place, under the Chairmanship of Mr. Alfred Bossom, when the subject was reviewed from its widest standpoint.

It was shown that not only had the introduction of modern methods and materials revolutionized building, but also had brought to a conclusion a long sequence of tradi-

tional styles of architecture, and had exerted a greater influence than any other factor in the development of a modern style.

Mr. Herbert Welch, who followed at the R.I.B.A., gave a lecture for which Sir William Collins, Chairman of the Chadwick Trustees, presided, on " The Construction of the Modern House," and in so doing fully dealt with one of the most popular of modern building problems.

These two lectures are to be followed by others, viz.—

3. Mr. Randal Phillips, Hon.A.R.I.B.A.—
" The Modern House and its Equipment."
4. Mr. A. H. Barker, B.A., B.Sc., M.Inst.C.E.—
" The Relative Advantages of Heating by Coke, Gas, and Electricity."
5. Mr. R. Fitzmaurice, B.Sc., A.M.Inst.C.E. (of the Building Research Station)—
" On Choosing Materials and Methods of Construction for Modern Buildings."
6. Mr. Burnard Geen, M.Inst.C.E.—
" The Modern Treatment of Foundations on Difficult Sites."

It should be explained that of Charitable Trusts few have a wider significance than that which has made itself responsible for the delivery of these lectures.

The Chadwick Trust, of which Mrs. Aubrey Richardson, O.B.E., is now clerk and lecture secretary, was fortunate in having by the generosity of Mr. Alfred Bossom, M.P., presented to it in the year 1925, a donation which enabled it to promote lectures dealing with improved methods and materials employed in building, and known as the Bossom Gift Lectures and Scholarship; also, every five years to award, at their discretion, a Scholarship for research in a kindred subject.

S. D. A.

THE CONSTRUCTION OF THE MODERN HOUSE

By HERBERT A. WELCH, F.R.I.B.A.

I PROPOSE to treat this lecture on somewhat broader lines than the title might strictly permit. In giving thought to the subject I have been unable satisfactorily to separate construction from design, and from internal finish. To deal adequately with all sides of the subject, would require far more time than can be given to a single lecture, so if I keep you longer than usual, and still leave you with the feeling that there is much more to be said, I crave your tolerance and forgiveness.

What do we mean by "The *Modern* House?" After spending some time in an endeavour to set forth a definition, I found it had been far better stated by Professor Lethaby as long ago as 1920, when he said:

> Our aim should be to develop a fine tradition of *living* in houses. It is a matter for experiment, like flying. We should seek to improve in detail, point by point. Exquisite living on a small scale is the ideal. "House-like" should express as much as "ship-shape." Our airplanes and motors, and even bicycles, are in their way perfect. We need to bring this ambition for perfect solutions into housing of all sorts and scales.
>
> The chief obstruction to our having better houses has been the superstition that they should be built in a *style.* There is a great difference between being built in an *imitative* style, such for instance as Elizabethan, Jacobean, or Georgian; and being built *with* style. A motor-car is built with thought for "style," that is, finish and elegance, but it is not built to look like a sedan chair or a stage coach. To be concerned with style imitations and period design is not only irrational in itself, but it blocks the way to any possibility of true development. To go on building houses in the cocked-hat and brass-candlestick style is not only rather imbecile play-acting, but it destroys rational growth. We have to put an efficiency style in the place of this trivial, sketchy picturesque. Even leaving out the style, *trimmings* would be

something. If you cut away disease and surplusage, you strengthen and consolidate. We have to prune our building forms as we prune a fruit tree, and sternly cut away the dead wood. Whenever we concentrate on some directing datum, some reality like health, serviceableness or even perfect cheapness, true style will certainly arise as the expression of *this* and the other human quality embodied.

The dwelling-house should be sound, dry, light, warm and sweet. We should save in all thoughtless extravagances, and concentrate on the conquest of dirt, disorder, and waste. *Houses must be built for living in.* A false and confusing opposition between science and art has been allowed to arise, but properly there is no strife between science and art in architecture. The art of house-building is practically one with the science of housing. If we must worry over strict definitions, " science " may stand for codified preliminary knowledge, and " art " for operative skill, experiment and adventure. Science is what you *know* ; art is what you *do*. The best art is founded on the best science. The notion that there are special " art forms " or " art colours " has led to all sorts of pretence and sham picturesquenesses. *Art is in fact high competence in doing what is worthy to be done.*

This is sixteen years old. It will still be fresh sixteen years hence.

Those of us who have reached or passed middle age were trained at a time when hand craftsmanship was at its highest. Our designs, surfaces and the choice of materials were influenced accordingly.

We are now at the beginning of the age of mechanical production. The machine has to a great extent replaced hand labour. However much we might regret the change, we must face it as an accomplished fact. No good purpose can be served by looking back and sighing for the past, however much joy we obtained from it—and we had a lot indeed—the present and the future call for a *fresh* line of thought, and we must address ourselves to the problem of fashioning the machine to our art, as we previously fashioned the mechanic or craftsman. The result will be a *different* expression, but there is no reason why it should be less satisfying or less beautiful.

What we now call the modern house first appeared in this country in 1926 when Professor Behrens built a house

at Northampton appropriately called " New Ways " for—equally appropriately—Mr. Bassett-Lowke. A year or so later Mr. Thomas Tait developed on modern lines " Silver End," an estate in Essex for Messrs. Crittalls.

In 1928 *The Architectural Review* published a survey on the modern movement which at that time had established itself in France, Germany and Czechoslovakia. At that time the above two examples were the sum total of our contribution to the movement.

Since then, however, the new manner has gained a firm hold in this country.

The progress has been gradual, due partly to our innate conservatism, but largely to the administration, or mis-administration, by Local Authorities of the powers given to them by the Country and Town Planning Acts, and by their by-laws—many of which are *years* out of date. On many occasions during the past five or six years the architect's ability and imagination has been nullified by Local Authorities under the powers vested in them who wanted merely something like the other houses along the road, or in the district. Until by-laws are brought up to date and made more uniform throughout the country, and narrow minds become broader in the administration of the Town Planning Act, the growth of modern work will continue to be stunted.

Passing from precept to practice, I propose briefly to take you through the construction of the house in the order in which the builder erects it.

In regard to *foundations*, I shall deal only with normal sites. Abnormal and difficult sites needing special treatment will be dealt with in a subsequent lecture. Practically all soils which have not previously been disturbed provide more or less good foundations.

On maiden soil a good foundation can usually be obtained at about 2 feet to 2 feet 6 inches below the ground level. If in clay, it is desirable to go down to 3 feet to avoid minor cracks which are otherwise liable to occur during an abnormally hot summer.

Experience has taught me that soils which appear to be

sound and satisfactory for building do not always offer an equal resistance to the load put upon them, and cracks subsequently appear in the structure. To make as certain as possible, the architect should get the builder to supply from say 6 to 12 lengths, about 4 feet long, of 1 inch or 1¼ inches iron pipe, and himself stand by while these are driven into the ground at various points below the bottom of the trenches from which the walls are to rise. The pipes will go down fairly quickly for the first 12 inches, after which they should go less quickly owing to increasing friction. If the resistance be even the soil is good, but if the pipe appears to slip through the soil quickly a bad patch has been struck, and the soil at such points should be taken out to a greater depth.

Concrete is the best and is therefore the material most commonly used for foundations.

The thickness will vary according to the load to be put upon it, but 9 inches to 12 inches thick will usually suffice. If the foundation ground is not too good, it will be well to reinforce the concrete with mild steel rods.

The width must accord with the by-laws, and have relation to the thickness of the wall.

The vegetable soil should be removed over the area of the house to a depth of about 6 inches to 9 inches before covering the surface with concrete.

Walls.—Brick has been the traditional British house-building material since the thirteenth century, and is still the most common in domestic work, because it can provide economically, in one material, both structural and facing finishes.

Of late years reinforced concrete has entered the field of construction. In this material a 2-storey building can be erected having external walls only 4 inches in thickness. When its properties are more fully developed it may be that we shall use it more freely, but the present necessary process of shuttering and reinforcement generally renders it more costly, more cumbersome, and less easy of alteration without undue risk when it has set.

Of the common building bricks available in the London and Home Counties, Flettons are the cheapest, and being

hard, even in size, and of good quality, are generally used. Common building bricks in great variety are obtainable all over the country.

These bricks generally are poor in appearance and will not withstand the weather. If used throughout the external walls they should be covered on the outside with a rendering about ¾ inch thick of cement and sand and finished with a second coat of similar material, giving a more or less rough texture known generally as roughcast. If preferred one of the more modern finishes such as Cullamix, Snowcrete, Cementone and the like might be substituted for roughcast.

If it be intended to face the external walls with what is known as facing bricks, these are available in great variety. Those known as sandfaced are best, and they vary in colour from light grey, plum, creamish-yellow, various multi-colour combinations, to red.

Mortar should be of lime and sand 1 to 2, or cement 1 to 4. Cement is the stronger. It is apt to cause efflorescence. It is also less elastic than a hydraulic lime mortar and cracks due to differences of temperature are likely to develop in large areas of walling where cement mortar is used. It sets more quickly than a lime mortar and is therefore very generally used. Cement is grey in appearance, and if used for pointing external faced brickwork tends to deaden or dull the surface appearance. To avoid this defect where cement mortar is used, it is not unusual to rake out the joints to a depth of about ½ inch to ¾ inch while the work proceeds, and later to " point " the joints with a mortar composed of lime and sand, adding a small proportion of cement for strength.

The minimum thickness of external brick walls for a 2-storey house will be nine inches if finished externally with roughcast, and 11¼ inches or 13½ inches if faced with brickwork.

While 13½ inches solid brickwork is stronger than a cavity wall of, say, 11¼ inches or even 16 inches thickness, it has been found that a solid wall 13½ inches thick is not weather proof in very exposed positions. It will be wise therefore to build in 11¼ inches or 16 inches cavity work.

These walls are constructed in two 4½-inch skins, or with

the outer skin $4\frac{1}{2}$ inches and the inner skin 9 inches thick, tied together with G.I. corrugated or twisted wall ties.

Realizing that, during driving rains, water will penetrate the outer thickness or skin, care must be taken to separate the two thicknesses, and in places where this is not practicable, great care must be taken to render the connecting link watertight externally.

The bottoms of the wall cavities and the tops of lintols must be frequently cleaned out (preferably once a day before the mortar sets) to avoid an accumulation of mortar droppings and brick bats, etc., which, if left, will set and connect into a more or less homogeneous mass the outer and inner skins of the wall, and convey dampness from the outside to the inside, and so defeat the purpose of the cavity walls.

A Damp-Proof Course should be laid horizontally at the base of the wall slightly above the outside ground level, and an inch or two below the ground-floor level. Those in most common use are 2 courses of slates bedded in cement mortar, asphalt in 2 layers about $1\frac{1}{4}$ inches thick, sheet lead, and bitumen felt, with or without lead incorporated in it. Of these bitumen felt is the cheapest, and lead or asphalt the dearest. Slate in cement is the most frequently and bitumen felt the most rarely now used.

Where the level of the lowest floor is below the level of the surface of the ground, a vertical damp course in addition should be applied on the outside face of the wall.

During the past ten years precast concrete lintols reinforced with steel rods or steel joists have superseded wood for use over door and window openings, in spite of being more expensive. They are stronger and do not shrink. The old trouble of cracked plaster at the back of the wood lintol, due to shrinkage, can now be easily avoided.

These lintols, however, generally connect the two thicknesses or skins of brickwork in the cavity wall, and must therefore be rendered watertight. This can be done by cement mortar rendering on the outside surface, and by the insertion over the head of a sheet lead apron as a damp-proof course, tucked into the joint of the inner thickness of the wall about 3 inches above the top of the lintol, and

taken through the external thickness of the wall at the level of the top edge of lintol. In addition it is well to give a fall to the lead from the centre of the lintol toward each end, to drain off into the cavity any water which might collect on the lead. It is also an advantage to leave open two or three of the vertical mortar joints in the brick course at the head of the lintol.

Although we have no tradition of *timber* building here as they have in America and Scandinavia, *framed walls* entirely of common deal, or of light steel joists and stanchions with deal joist infilling, are occasionally used in rural or semi-rural districts. By this means wide spans can be easily made, and planning is in consequence much more free than is the case with brick construction, since the partitions on the upper floor need not be supported by those below. The sheathing or finishing materials can be standardized and fabricated in large sections, thereby reducing to a minimum the work on the site, and increasing the speed of construction. In this method of construction " wet " materials are less used, and building progress is not therefore interfered with by bad weather.

Including the insulating material essential to this form of construction, and the plaster and cement finish internally and externally, the external walls of a 2-storey building can be well built within a thickness of about 7 inches.

A few years ago my partner and I erected some small houses in the Midlands in somewhat this form, whereby the thickness of the external walls was reduced to 2 inches. This was achieved by placing the light steel stanchions and joists on the inside face of the " wall " and by arranging the intermediate timber framing at distances of 4 feet apart.

Such framed buildings could be, and are in fact, equally well finished externally in wood weather boards, for which purpose deal, oak, elm, teak, cedar and other woods are suitable.

Of recent years metal for windows has to a great extent superseded wood. These windows are made in various standard sizes both with and without glazing bars. Metal has the advantage that it does not shrink or swell, also that it is

practicable to use smaller sections, thereby providing more daylight in the same size opening. As to ventilation, these windows are at present practically limited to " opening out " and collapsible, or " sliding-folding." The latter are too expensive for general use, so for all practical purposes their use limits us to the casement type of window, in which both large and small sections are made to open. I look forward to the time when the manufacturers will introduce a type of window similar to that in general use in motor-cars and railway carriages. It can be done, and would be a good substitute for our loss of the old wood double hung sash, which is the best venilator of all windows to date.

Metal windows can be fixed by metal lugs built direct into the brickwork, or fixed first into deal frames which in turn are fixed to the brickwork. They are usually made with wide opening hinges for easy cleaning.

These windows have become so popular that I think it unlikely we shall return to the old wooden windows for general use.

To keep down surface dampness it is essential that a layer of cement concrete 4 inches to 6 inches thick be laid over the area between the external walls under the ground floor.

Wooden floor construction remains in most general use, and I consider it will do so for some time yet, for much the same reasons that I gave just now for the more general use of bricks rather than concrete in walls.

On the ground floor in particular, ample ventilation must be provided ; it is the only sure antidote to dry rot. It is not unusual to provide *solid* floors on the ground floor by means of wood blocks, or by boards fixed to small deal fillets, which in turn are fixed to the surface concrete. Solid floors can be recommended in the hall, lavatory, scullery and out-buildings (where in most cases tiles or cement will replace wood blocks), but most people find solid floors in living-rooms tiring to the feet.

Whether flat or pitched, roofs will generally be constructed of deal. The only satisfactory substitutes are concrete or terra-cotta blocks. These are at present costly, cumbersome in construction, delay general progress and are subject to

expansion and contraction unless well insulated where exposed to extreme heat and cold.

The angle of the pitched roof will largely depend upon the material to be used for its covering. If tiles are to be used 40° is the flattest pitch, but 50° provides a more water-tight roof and looks better generally. If slates are to be used a pitch of from 30° upwards is practicable.

The roof will have to withstand severe wind pressure and and should therefore be well braced, strutted and tied together, or the ceilings over the first floor will crack abnormally.

To the rafters, deal boarding and battens, or weather boarding (with or without felt) are fixed to receive the tiles or slates. " Nibbed " tiles should be laid to proper lap and nailed at least every third course. Every slate should be nailed with two galvanized wire nails. Care should be taken that the lead flashing, soakers, and aprons have ample lap, and are not cut small, or dampness will show itself inside the roof.

If the roof is to be flat (and modern design is at present closely associated with the flat roof), a number of good materials are available—lead, copper, rock asphalt, " Macflex " and other bituminous materials. In whatever material it is finished this form of roof should be insulated with fibre board, cork slabs, or similar non-conductor of extreme heat and cold.

The material best suited as a surface finish, and the slope of the flat roof will largely depend upon the use intended to be made of it. The slope or fall should be not less than 1½ inches in 10 feet.

Most of the asphalts and bituminous materials are liable to soften during hot weather, and to leave on their surface the impression of chair and human feet marks. For this reason, and because some Local Authorities require it, it is well to lay on such surfaces gravel and cement rendering, Thermotile or similar insulating and hard-wearing material. The eaves may be finished by means of a parapet wall or a wide oversailing roof, whichever best suits the design and the purse.

Asphalt, if laid on flat roofs of wooden construction, should be reinforced with chicken wire or expanded metal.

It is a little surprising that the one-span roof rarely appears in modern buildings. It has the advantage of avoiding a great deal of the waste of space usual with double-pitch roofs, yet provides sufficient space for water tanks, etc. Its use is associated more with rural than with urban districts and it has recently reappeared in some very delightful small houses at Tewin, near Welwyn. With our aptitude for compromise, it is a little odd that this " half-way " between the double-pitch and the flat roof has been so long neglected. Maybe we shall see more of it in the future.

We must now pass to the inside of the house.

The partitions generally will be brick or concrete, but where the necessary support is not available on the upper floors, recourse must be had to what are known as " slab " or block partitions. These are made of coke breeze, Terra-cotta and Pumice, and vary in thickness from about 2 inches to 4 inches. They are light, provide a good fixing for joinery, a good key for plaster, and are easy to handle and fix.

In an emergency our old friend the wood or " stud " partition is still called to our aid.

At this stage, if building in an urban area, the supply companies will have brought in the gas, electric light and water mains and left them inside the house for the builder to deal with.

A galvanized iron water storage tank of from 60 to 80 gallons upwards (depending upon the number of persons to occupy the house) will be fixed in the roof, preferably near a chimney stack from a coal fire, to reduce to a minimum the liability to freezing, for which reason it should be encased in a wood box, leaving a margin of about 2 inches to 3 inches on all sides for packing with slag wool or cork shavings.

Near the entry of the water main into the house a tap should be fixed to enable the water to be cut off; the main should then be continued to the meter and thence to the storage tank. Off the main there should be taken a branch to the kitchen sink (and possibly another point) for drinking purposes. From the tank branch services will be run to the

various sanitary and other water fittings. It is desirable not to bury these pipes in the walls; it is, however, also desirable that care be taken so to arrange their "runs" that they do not appear on the walls in an unsightly manner.

Hitherto lead has generally been used for these mains and services, but later G.I. and later still copper has come into use. Stop cocks fixed on to each branch enables every basin, bath or sink to be separately controlled without throwing out of use the remainder of the fittings.

Gas and electric light services will be run from the mains to their respective meters in much the same way, and from thence to the various points required. Steam barrel is generally used for gas, and metal tube in various forms for electric lighting. Screwed tube is about the best material. These pipes can be buried in the walls with less risk.

For *heating* there are available for our choice hot water (by coke- or gas-fuelled boiler), steam, and electricity.

The open coal fire dies very hard, and most people will wish to have one in the living-room. I doubt if it is necessary elsewhere in the average house.

The other rooms should be provided with gas or electric power points for occasional fires, both of which elements offer certain advantages. Central heating will be required to some extent, and assuming economy to be an important factor I recommend the use of a boiler that will deal both with a moderate amount of central heating, and with the domestic hot water supply. I therefore have in mind H.W. for central heating.

The most suitable position for the boiler will depend upon whether it is to be coke or gas fed (electricity for this purpose is at present far too dear). Gas is about double the cost of coke, but coke is very dirty, and the boiler if thus fed involves a great deal of time in refuelling, cleaning and clinkering.

Assuming the house to be of moderate size, say 4–5 bedrooms and 2–3 sitting-rooms and 2 bathrooms, needing about 4 radiators, the boiler might be fixed in the kitchen or scullery near the cooker provided it be gas fired. To save cleaning the boiler should be stove-enamelled, it should have an insulated jacket to retain heat, and be of the type which

enables the central heating section to be cut off during the summer.

Each radiator should be capable of separate control, the circuit or flow being closed by a valve or cock. If the "indirect" system be adopted, the H.W. drawn off for baths and other fittings does not come into contact with the boiler and thereby eliminates the necessity for scaling the pipes.

Until recently it has been usual to run H.W. services in steam barrel pipes, but of late copper piping, having sweated joints, has been introduced. This system is slightly more costly both for hot and cold services, but it renders unnecessary wiped or screwed joints and avoids "firring." The joints in this piping can be "undone" by the simple application of a blow lamp on the joints.

It is probable that before long copper piping will be exclusively used.

The *Rooms and their Finishings*.—It is the present fashion to keep wall and ceiling surfaces much more plain than hitherto. Finishes must be bright and easy to keep clean, effects must be obtained by colour, and the appropriate choice and use of materials, instead of by heavy mouldings and deep projections.

Entrance Hall.—There will rarely be more than sufficient space in the Hall for practical purposes, and its detailed treatment will therefore be the more necessary. A hat and coat cupboard is essential. It need not be large, probably the men only will use it. About 3 feet long and 9 inches to twelve inches deep will generally suffice. A large mirror near by will be useful. Don't be afraid to extend it up to the ceiling, it will increase the apparent size of the hall, and produce some unexpected and interesting effects.

If the telephone is to be fixed here, thought should be given in determining its best position. Provision should be made for a shelf arrangement capable of taking the instrument and books when open and closed, and a writing-pad. This can be done in a space of about 24 inches × 12 inches × 4 inches.

The bell box can be placed beneath and so out of sight.

The *Living-room*.—A S. to S.W. aspect is the most suitable,

and if a loggia or verandah for sitting out in summer can be arranged it will be enjoyed. If properly planned for comfortable living, this room should be large enough to be subdivided into two or more sections or zones for the various family activities. The space available will be best used if each section be equipped with simple built-in furniture such as a bureau, bookshelves, wireless and gramophone cupboard, sewing cupboard and drawers, cocktail cabinet, and cupboards to contain the various items required for use more or less often. If much writing is to be done and a separate study be not available, a filing cabinet and space for a typewriter (which might be enclosed when not in use) might be provided.

The sitting portion of the room will be the most important. It should be at least 13 feet wide, and care should be exercised in placing the fire that it will be free from draughts and yet provide ample free space about it for the placing of chairs and possible a fixed settee. The design of the fire surround and the fitments should be in harmony.

For artificial lighting, one or more ceiling points for general lighting, 1 table-lamp near the writing-desk, 1 standard reading-lamp near the fire is the minimum.

I have generalized in the treatment of this room, because its detailed form will vary to a more or less degree according to the habits of living of every family.

For the *Dining-room.*—An east aspect is the best. The sun is never quite so welcome as at breakfast time.

Whether this be in the form of a separate room or a recess off the living-room, it should be 12 feet at least in width if required for the use of a family, and its position as near as practicable to the kitchen. It should be planned to take a dining table of the size required, six to ten chairs, side-board fitment having space for the storage of drinks—with a draw-out shelf beneath, cutlery and the like.

If it is desired to have direct connection with the kitchen by means of a hatch, this will be most conveniently arranged as part of the sideboard fitment. This fitment might conveniently occupy a wide opening in the partition, and be designed to take the kitchen requisites on the one side and

those required for the dining-room on the other. Double sliding doors should be arranged to reduce sound and kitchen smells penetrating the dining-room. Some form of insulation against sound is also desirable in such a fitment.

If central heating be not available a gas or electric fire fixed flush with the wall will occupy the least space, and give sufficient heat for the purpose, if lighted a short time before meals.

Where the living-room and dining-room are planned adjoining each other, a wide opening is sometimes left in the partition separating the rooms. Such an arrangement has advantages for dancing and for large social parties and events, but it tends to make both of the rooms less comfortable and convenient for ordinary uses. In addition the large size of such an opening is generally out of scale with the remainder of the features in the room, and therefore upsets their appearance.

For general lighting a ceiling point over the table and another over the sideboard is all that is necessary.

The *kitchen* (if no scullery or pantry is provided) will be the workshop of the house and therefore needs most careful planning. It must be arranged to reduce work and avoid drudgery. Special consideration must be given to its equipment. Their inter-relationship also is equally important, and the fitments should be so placed that the various jobs of work take place in ordered sequence.

The storage of goods is of primary importance. Perishable goods should be stored in a place not affected by the heat during cooking. A refrigerator therefore is a necessity. A number of admirable models are available and can be obtained to fit under the draining-board, free on the floor, or built into the wall or cupboard at a convenient height above the floor level. This last is the most convenient, inasmuch as everything can be readily seen, and it avoids undue stooping. For a family of 4 to 6 people a 2 or 3 cubic feet model is sufficient.

Dry goods, fruit, vegetables and the like will be stored in the larder. This need not be large, but it should be

fitted with at least one slate or tiled shelf, and the wood shelves should be fixed about 1 inch clear of the walls for free ventilation. The window should be on a north or north-east wall, and a ventilating brick or two should also be provided. The floor should be tiled and the walls too. If tiling be too costly, paint enamelled finish might be substituted.

Dry goods that are frequently in use should be stored near to the cook's table in a small fitment designed to take bottles, glass containers and canisters.

If space does not suffice for table and fitting, there are available a number of fitments ingeniously arranged to serve both purposes.

A range of cupboards high up on the walls will be useful for the storage of jams, bottled fruits and the like, which are required only at long intervals. These cupboards can be very shallow, providing room for 1 bottle deep say about, 4 inches, with shelves spaced about 5 inches apart.

The sink should be placed near the table and might be of glazed earthenware or stainless steel, having draining boards at both ends if space permits. If space and cost permits two sinks—one for washing and the other for rinsing—is better still. Swivel taps are better than two ordinary taps. Cupboards with flush doors should be fixed beneath the sink and draining-boards, the shelves in one cupboard being arranged to accommodate a pail.

It is a matter of opinion whether the sink is best placed under or at the side of a window. I favour the latter position provided the window be near to the sink, for it allows better use to be made of the space at the back of the sink, is more convenient for the fixing of plate racks, and it is easy to keep the window curtain clean and tidy.

Whether the cooking be by gas, electricity or solid fuel, will be a matter of choice, having regard to the fuel available and its cost. There is a wide range of efficient cookers available in all these categories. The old solid-fuel range has been largely superseded by one which burns night and day, requires refuelling only once in 24 hours and consumes but little fuel. If gas or electricity be used, a hood to collect

the fumes and a flue to convey them to the open air are essential.

Space should be found near the kitchen door for a storage cupboard for brushes and cleaning materials, vacuum cleaner, ironing-board, etc., and fitted with drawers for string, paper and other odds and ends.

Of the smaller items found to be of great convenience but not always provided, I would mention recessed soap-dishes, plate-rack, electric plugs for iron, toaster and coffee percolator, enclosed steam-proof E.L. fitting, and a heated towel rail for drying cloths.

Bedrooms should be planned to leave reasonable space for double or two single beds in two rooms out of four. Built-in fitted wardrobe and dressing-table are a great convenience and ofttimes save space. If these fittings are an integral part of the room design and are well done, its appearance becomes enhanced, and what is equally important, passers-by are not likely to see the back of the dressing-table mirror standing up in front of the window.

A gas or electric fire fixed flush with the wall and having a small flue, or even a portable fire will give sufficient heat to supplement that which circulates from the H.W. radiator on the landing. Where no open fire exists, air brick ventilation or a permanently open space over the window is necessary.

Where only one bathroom is available, a wash basin might be serviceable in one or more of the bedrooms. If space permits this might be enclosed in a cupboard with tiled back and sides, a small cupboard beneath the basin and glass shelves above. Chromium-plated service pipes can now be had. Their appearance is far better than lead.

A light point over the bed and another over the dressing table is essential, and it is a joy to have one in the wardrobe cupboard operated by the opening and closing of the door.

Bathroom.—The bath and basin should be ample in size and of simple rectangular shape. Whether the bath is to be fitted with panelled sides and end, and if so, in what kind of material, will be affected by the treatment of the walls. I prefer the walls and face of bath to be of the same or

similar material. Whatever the material, be sure to provide a "trap" or inspection door in the side of the bath enclosure of sufficient size to enable repairs to be made to the waste and service pipes.

The taps should be $\frac{3}{4}$ inch and the waste $1\frac{1}{2}$ inches diameter for quick filling and emptying. Easy cleaning taps in chromium and a plug and chain outlet are best. Taps might be fixed at the end or in the centre of the bath. The latter are more easy to reach when the bath is occupied, but when getting out of the bath they are liable to come into painful contact with one's hip. A recessed sponge and soap tray (better still one of each) should be provided, which should have a grip handle to assist in getting out of the bath.

The basin should have 2 soap-trays, tap at each end, and a skirting for preference. It is best and cheapest if fixed to the walls on enamelled iron fittings, which if in the form of brackets can be used to hang towels. Over the basin a mirror and glass shelves or a recessed shaving cabinet fitted with glass shelves and having a mirrored front might be substituted. A cupboard might be formed under the basin where medicines, etc., can be stored. A double H.W. towel rail will complete the fittings.

The wall surfaces might be finished with tile, glass, vitrolite, enamel, or a combination of these or similar materials. Where expense is a consideration a dado 4 feet high of tiles or vitrolite, enamel painted above will suffice. The floor might be of lino, rubber or patent jointless material laid on the floorboards.

A ceiling light should be provided and if fixed within 2 feet of the window, the human form emerging from the bath will not throw a shadow on the glass. A wall bracket near the shaving cabinet should also be provided.

The *W.C.* apartment might be finished similar to the bathroom. The "high up" cistern has lately given place to the "low down" which is better provided the water flush be sufficient. This looks neatest when the cistern is "tucked away" in a cupboard and only the handle or push button is visible. In such cases the cistern should be easily get-at-

able for adjustment and repairs. The toilet-roll holder should be recessed.

Finally the *linen cupboard* at least 18 inches deep fitted with the H.W. storage tank or a coil, open slat shelves 10 inches to 12 inches apart. It will be a great convenience to fit into this cupboard a sliding shelf for sorting and stacking the linen.

For wall and ceiling finishes there is, as yet, no satisfactory substitute for plastering generally. Metal lathing has to a great extent superseded wood lathing, its main defect is its tendency to rust. Fibre boards too—of which there are many on the market—are taking the place of lathing and the first coat of plaster for ceilings and also for some wall finishes. They are quicker to fix and help to deaden sound. Where it is desired to plaster on these boards, the manufacturers' instructions should be carefully followed, particularly as to the kind of plaster best suited to adhere to the board. Some of these boards are made with a " V "-shaped joint and have a texture well suited to finish by distemper or paint without plaster.

Doors generally will be of laminated wood, which if well made neither shrinks nor warps. These are made in a number of stock sizes and can be finished in almost any wood, the choice of finish will depend upon whether or not it is required to paint them.

Deal floors will be generally used, but if cost permits parquet or oak boards in narrow widths and long lengths look and wear better in the hall, living- and dining-rooms.

Linoleum should not be laid on floorboards in a new house, for at least a year after completion.

Window " boards " or ledges might be finished in wood, tiles, vitrolite or glass.

If paint for wall and ceiling surfaces is too costly, a wide selection of distemper is available.

Pale tints only, such as cream, ivory white and the like should be used on new plaster.

Printed in Great Britain by
Butler & Tanner Ltd.,
Frome and London